

CLAIMS

1. A length measuring instrument for measuring the length of a part (90) being measured by the draw-out length of a measuring belt (30), comprising:

5 a housing (10);

a rotary shaft (20) rotatably held inside said housing;

the measuring belt wound around said rotary shaft so that one end portion thereof is fixed to the rotary shaft, comprising a latching tool (32) on the other end portion, and causing said rotary shaft to rotate in the forward direction when the measuring belt is drawn out from the side of said other end portion to the outside of said housing;

10 a rotary shaft drive unit (40) provided inside said housing and rewinding the measuring belt by rotating said rotary shaft in the reverse direction;

an optical modulating section (100) provided in communication with said rotary shaft and used for converting light from a light source (120) into optical modulation signals;

20 a measurement unit (200) provided inside said housing for converting said optical modulation signals into electric pulse signals, counting the number of said electric pulse signals, determining the draw-out length of the measuring belt from the counted number, and displaying the determined length as a measurement result;

a latching section (50, 80) provided outside said housing and capable of latching with the latching tool of said measuring belt; and

a guiding unit (60, 70) having the prescribed length
5 and formed on the outer side surface of said housing,

wherein said measurement unit comprises said light source, a photoelectric conversion unit (122) for converting said optical modulation signals into photoelectric conversion signals, a pulse formation circuit (210) for converting said
10 photoelectric conversion signals into electric pulse signals, a length determination unit (232) for determining the draw-out length from the number of said electric pulse signals and outputting the determined length, wherein said length determination unit comprises a forward/reverse rotation
15 judging section (238) for deciding as to whether said rotary shaft rotates into forward direction or reverse direction from said electric pulse signals, and a pulse counting section (236) that addition counts the number of said electric pulse signals when said forward/reverse rotation judging section
20 decides that the rotation is in the forward direction, subtraction counts the number of said electric pulse signals when said forward/reverse rotation judging section decides that the rotation is in the reverse direction, and outputs the final count number obtained as a result of said addition
25 counting and subtraction counting as said measurement result;

and wherein said guiding unit comprises a distal end section (76) provided with said latching section, and the

measuring belt that has been drawn out from said housing is guided till the distal end section is reached along said guiding unit, and said latching tool is latched with said latching section and cues the measuring belt.

5 2. A length measuring instrument for measuring the length of a part being measured by the draw-out length of a measuring belt, comprising

 a housing;

 a rotary shaft rotatably held inside said housing;

10 the measuring belt wound around said rotary shaft so that one end portion thereof is fixed to the rotary shaft, comprising a latching tool on the other end portion, and causing said rotary shaft to rotate in the forward direction when the measuring belt is drawn out from the side of said
15 other end portion to the outside of said housing;

 a rotary shaft drive unit (40) provided inside said housing and rewinding the measuring belt by rotating said rotary shaft in the reverse direction;

 an optical modulating section (122) provided in
20 communication with said rotary shaft and used for converting light from a light source into optical modulation signals;

 a measurement unit provided inside said housing, converting said optical modulation signals into electric pulse signals, counting the number of said electric pulse signals,
25 determining the draw-out length of the measuring belt from the counted number, and displaying the determined length as a measurement result;

a latching section provided outside said housing and capable of latching with the latching tool of said measuring belt; and

a guiding unit having the prescribed length and
5 formed on the outer side surface of said housing,

wherein said measurement unit comprises said light source, a photoelectric conversion unit for converting said optical modulation signals into photoelectric conversion signals, a pulse formation circuit for converting said
10 photoelectric conversion signals into electric pulse signals, a length determination unit for determining the draw-out length from the number of said electric pulse signals and outputting the determined length, wherein said length determination unit comprises a forward/reverse rotation
15 judging section for deciding as to whether said rotary shaft rotates into forward direction or reverse direction from said electric pulse signals, and a pulse counting section that addition counts the number of said electric pulse signals when said forward/reverse rotation judging section decides that the
20 rotation is in the forward direction, subtraction counts the number of said electric pulse signals when said forward/reverse rotation judging section decides that the rotation is in the reverse direction, and outputs the final count number obtained as a result of said addition counting
25 and subtraction counting as said measurement result;

and wherein said guiding unit is formed as a rod-like body (72) having one end section thereof (74) rotatably

connected to said housing, the other end section of the rod-like body constitutes the distal end section where said latching section is provided, and the measuring belt that has been drawn out from said housing is guided till the distal end section is reached along said guiding unit, and said latching tool is latched with said latching section and cues the measuring belt.

3. The length measuring instrument according to claim 1 or 2, wherein said optical modulating section comprises a rotary optical modulation plate fixed to said rotary shaft, and said rotary optical modulation plate comprises a transparent disk and a plurality of portions (104) for regulating the quantity of transmitted light arranged successively and adjacently on the surface of said transparent disk.

4. The length measuring instrument according to claim 1 or 2, wherein said optical modulating section is constituted as a rotary optical modulation plate provided directly or indirectly on the rotary shaft, and said rotary optical modulation plate comprises a transparent disk (102) and a plurality of portions for regulating the quantity of transmitted light arranged successively and adjacently on the surface of said transparent disk.

5. The length measuring instrument according to claim 3 or 4, wherein some of a plurality of said portions for regulating the quantity of transmitted light are light-shielding areas and the remaining part of a plurality of said

portions for regulating the quantity of transmitted light are light-transmitting areas of different width in the rotation direction of said rotary optical modulation plate.

6. The length measuring instrument according to claim 3
5 or 4, wherein a plurality of said portions for regulating the quantity of transmitted light are light-transmitting areas with different light transmittances.

7. The length measuring instrument according to any one
of claims 1 to 6, wherein said light source is a semiconductor
10 light-emitting element, said photoelectric conversion unit is a semiconductor light-receiving element, and said semiconductor light-emitting element and semiconductor light-receiving element are disposed opposite each other so as to sandwich said optical modulating section therebetween.

15 8. The length measuring instrument according to any one of claims 1 to 7, wherein said rotary shaft drive unit is a spiral spring.

9. The length measuring instrument according to any one
of claims 1 to 7, wherein said rotary shaft drive unit is an
20 electric motor.

10. The length measuring instrument according to any one
of claims 1 to 9, wherein said measurement unit further
comprises a storage device (222) for recording the measurement
information such as a display mode and said measurement
25 results in a readable form, a display section (226) for displaying said measurement information, an input unit (224) for selectively inputting a variety of commands instructing to

select the displayed measurement information, determine the recording of measurement result, and clear the measurement information displayed in said display section, and a display control unit (234) for controlling the display in said display
5 section according to the command from said input unit.